Nov. 24, 1964 A. BLOOM 3,158,152

MOUTH TO MOUTH RESUSCITATOR

Filed Sept. 16, 1960

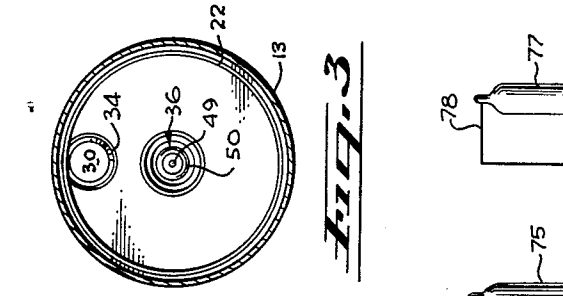

Fig. 3

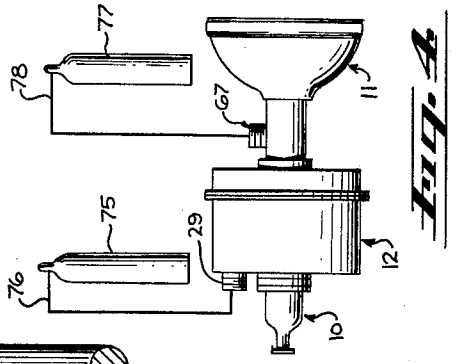

Fig. 4

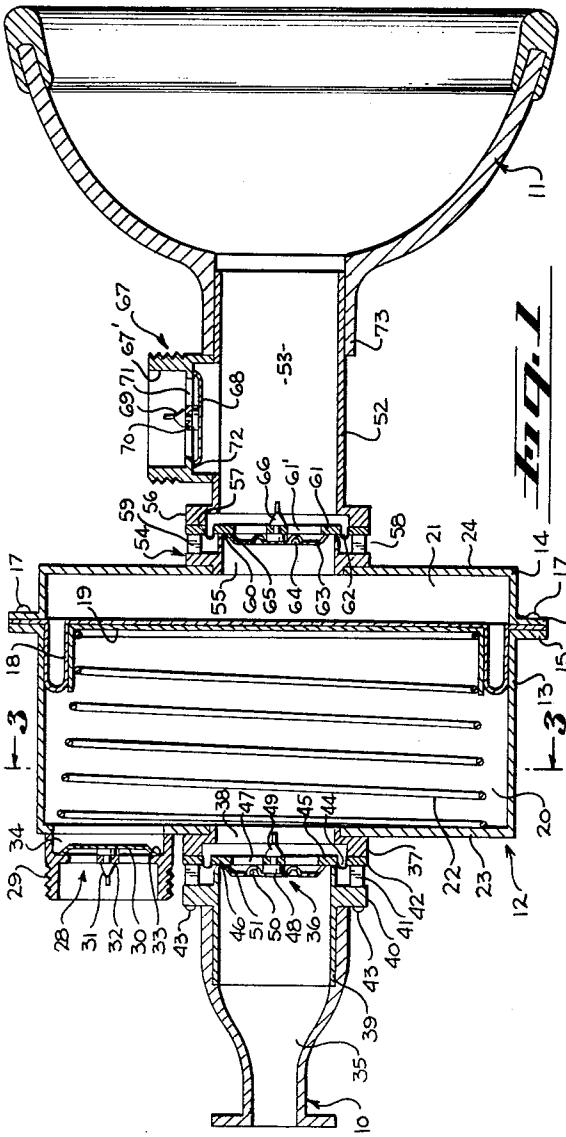

Fig. 1

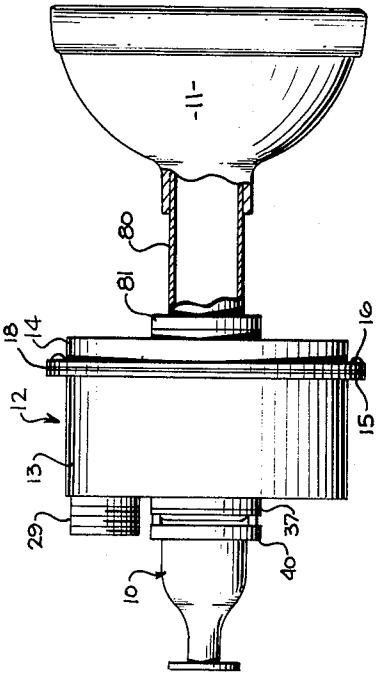

Fig. 2

INVENTOR.
AARON BLOOM
BY
Beehler & Shanahan
ATTORNEYS

United States Patent Office 3,158,152 Patented Nov. 24, 1964

3,158,152

MOUTH TO MOUTH RESUSCITATOR

Aaron Bloom, Pasadena, Calif., assignor to Sierra Engineering Company, Sierra Madre, Calif., a corporation of California

Filed Sept. 16, 1960, Ser. No. 56,458
4 Claims. (Cl. 128—29)

The invention relates to resuscitation for persons whose breathing has been temporarily impaired and consists of essentially a device the purpose of which is to provide a means for mouth to mouth resuscitation without the necessity of direct exchange of respiratory gases between the patient and the administrator or operator, the device being further one for controlling the tidal volume displacement and thoracic pressure.

More particularly, the invention is directed to a device, one end of which is insertable into the mouth of a patient and the other end of which is applicable to the mouth of an operator, there being provided a divided chamber therebetween, separated by a flexible partition and sundry valving so arranged that the patient inhales fresh air independently of the operator who also inhales only fresh air.

The problem of resuscitation or artificial respiration has long confronted the medical profession and administrators of first aid. Most commonly artificial respiration is performed by manipulating the arms and chest cavity of a person needing resuscitation in order to alternately depress and expand the chest cavity and lungs in a sequence endeavoring to simulate natural respiration. The artificial respiration technique is the quickest and most commonly employed because, when resuscitation is needed the need is urgent and immediate and it must be practiced without delay if the patient on many occasions is to survive. Needless to say the practice of artificial respiration of the kind described is effective only in the hands of persons conversant with the technique and although badly needed often-times fails to produce the necessary result because of lack of skill on the part of persons immediately available.

On occasions where there is opportunity to employ mechanical respirator devices such as the commonly known pulmotor have been employed. These devices supplied by artificial pumps are capable of being regulated to a more realistic rhythm and have the advantage of an adequate amount of power by means of which to force fresh air into the lungs. The devices heretofore available however have been somewhat complicated, expensive to procure; and of such construction that unless handled by experts damage to the patient may be suffered.

On some occasions mouth to mouth resuscitation has been practiced by a technique which requires the operator to place his own mouth over the mouth of the patient, thereby to breathe air from the lungs of the operator into the lungs of the patient. Although this direct method is physically less tiring for the operator, it has the singular disadvantage of making it necessary to breathe into the lungs of the patient air having a heavy portion of carbon dioxide exhaled by the operator and hence deprives the patient of an abundance of oxygen such as would be present in the natural air. Also under extenuating circumstances where the patient may have been subjected to discomfort resulting in nausea it becomes extremely difficult for the operator to overcome a degree of physical repulsion to the extent necessary to administer direct mouth to mouth resuscitation.

It is therefore among the objects of the invention to provide a new and improved device for making possible use of mouth to mouth resuscitation in such fashion that natural air uncontaminated by the operator is forced

directly into the lungs of the patient and thereafter permitted to be exhaled.

Another object of the invention is to provide a new and improved device for the performance of mouth to mouth resuscitation which is capable of minimizing fatigue on the part of the operator while at the same time affording the patient the opportunity to breathe natural air and exhale naturally.

Still another object of the invention is to provide a new and improved apparatus for enabling the performance of mouth to mouth resuscitation which incorporates safety features in that the apparatus is built with a maximum capacity no greater than that which is a safe capacity for the lungs of the patient which capacity cannot be exceeded regardless of the inexperience of the operator.

Still another object of the invention is to provide a new and improved apparatus for the performance of mouth to mouth resuscitation which makes a direct physical contact between the patient and the operator unnecessary.

Also included among the objects of the invention is to provide a new and improved mouth to mouth resuscitation device which is relatively inexpensive, which is compact and therefore easily portable and which, moreover, is positive and safe in its action, to thereby greatly improve the administration of artificial respiration where needed.

With these and other objects in view, the invention consists of the construction, arrangement and combination of the various parts of the device whereby the objects contemplated are attained, as hereinafter set forth, pointed out in the appended claims, and illustrated in the accompanying drawings.

In the drawings:

FIGURE 1 is a longitudinal sectional view of the device of the invention in its most complete form.

FIGURE 2 is a side elevational view of a more simplified form of the device with a portion broken away.

FIGURE 3 is a cross-sectional view taken on the line 3—3 of FIGURE 1.

FIGURE 4 is a schematic view of the device drawn to a smaller scale and illustrating the application of air or oxygen from special containers to the device.

In an embodiment of the invention chosen for the purpose of illustration the device is shown as one comprising a patient mouthpiece 10, an operator mouthpiece 11 and a housing 12 to which the mouthpieces are connected by appropriate means.

More particularly the housing already indicated generally by the reference character 12 consists of a part 13 and a part 14 which are secured together adjacent flanges 15 and 16 respectively by means of some appropriate fastening means such as screws 17. Between the flanges there is secured a flexible diaphragm 18 which is reinforced over its central area by the presence of a rigid cup 19 in a form such that the diaphragm is adapted to flex adjacent its outer perimeter. The diaphragm being secured in seal relationship between the flanges 15 and 16 provides within the housing two chambers namely a gas supply chamber 20 and a gas pressure chamber 21. Within the gas supply chamber 20 is a spring 22 one end of which is received in the cup 19 and the other end of which is adapted to press against an end wall 23 of the housing 12. Action of the spring 22 serves normally to bias the diaphragm in a direction away from the end wall 23 and toward an end wall 24, thus to normally open the supply chamber 20 to its condition of maximum capacity.

A check valve device 28 is contained within a fitting 29 in the end wall 23 and comprises a valve element 30 secured at the center by a valve stem 31 to a spider 32. Although various check valve devices are acceptable there is shown by way of example a check valve device wherein

the valve element 30 is of flexible resilient character such that it flexes away from the seat 33 when gas or air is sent through an inlet port or passage 34 into the supply chamber 20. The valve element reseats upon the seat whenever pressure is exerted upon the gas within the supply chamber 20.

In the patient mouthpiece is a passage 35 for air which is in communication past a combination inhalation-exhalation composite valve device 36.

A bushing 37 defines an aperture 38 forming a passage in communication with the supply chamber 20.

A nipple 39 to which the patient mouthpiece 10 is secured includes a flange 40 having lateral openings 41 therein and which is made use of to secure the nipple to the bushing. A valve element 42 serves as a seal for the rim of the bushing 37 and is compressed upon the bushing by the flange 40 which is secured thereto by appropriate means such as screws 43.

The valve element 42 in the chosen embodiment has an annular flexible bead 44 which under operating conditions permits a mid-portion 45 to shift from left to right as viewed in FIGURE 1. The mid-portion is adapted to serve as a valve element and to seat upon an annular valve seat 46 which is part of the nipple 39. In the mid-portion 45 are openings 47 and mounted upon the mid-portion is a flexible check valve element 48. A stem 49 of the check valve element securely fastens the check valve element to the mid-portion at its center. The check valve element 48 includes a flexible bead 50 in the chosen embodiment which permits the outer perimeter of the check valve element to lift from an annular valve seat 51.

On the opposite side of the housing 12, the operator mouthpiece 11 is connected thereto by means of a tube 52 which forms a passage 53. A bushing 54 mounted centrally in the end wall 24 providing a passage 55 therethrough in combination with the pressure chamber 21, the passage 53 and the area within the operator mouthpiece 11 may be aptly described as a composite pressure cavity.

At the left end of the tube 52 as viewed in FIGURE 1 is a flange 56 upon which is seated the outer annular portion of a valve element 57. The bushing 54 is provided with a flange 58 having openings 59 therethrough which establish a pressure vent port. On the bushing 54 there is also provided an annular valve seat 60 upon which a mid-portion 61 of the valve element 57 is adapted to seat. The valve element includes a flexible bead 62 in the chosen embodiment which permits the mid-portion to move from left to right away from the seat 60 and to return thereto at appropriate phases of the cycle.

Mounted upon the mid-portion 61 is a flexible valve element 63 which being likewise provided with a flexible beaded portion or bead 64 is enabled to have the rim thereof move from right to left away from an appropriate annular seat 65 at appropriate phases of the cycle. A valve stem 66 is employed to anchor the valve element 63 to the mid-portion 61 of the valve element 57.

On one side of the tube 52 is a fitting 67. A valve element 68 of flexible character similar to the valve element 30 is secured by means of the stem 69 to a spider 70 in such fashion that when air or gas passes into the inlet port 67' through openings 71 the valve element 68 is lifted from a seat 72 thereby to admit air or gas into the passage 53.

The operator mouthpiece is of such character that an extension 73 thereon may have a snug slip fit over the tube 52 in such manner that when needed the mouthpiece can be removed for replacement by another mouthpiece which may be a newly sanitized mouthpiece or one belonging to a different operator.

Although the device in the form described is well suited to use in atmosphere occasions may arise where the atmosphere is contaminated with smoke, toxic fumes or irritants to the extent that pure oxygen or purified air may be preferable. Under such circumstances a tank 75 of oxygen may be attached by means of a hose 76 to the

fitting 29 at the patient side of the housing. Similarly a tank 77 of oxygen or other gas may be attached by a hose 78 to the fitting 67 thereby to substitute a selected gas for the normally surrounding atmosphere.

In use the patient mouthpiece is inserted between the teeth of the mouth of the patient. The operator then applies his mouth to the operator mouthpiece 11 and when using the invention described in FIGURE 1 can remain with his mouth affixed to the mouthpiece. The operator then exhales firmly at which phase of the cycle the valve element 68 will close and respiratory gases from the operator will pass through openings 61' in the valve element 57 lifting the valve element 63 from its seat and thence pass into the pressure chamber 21. The operator can continue to exhale through this phase of the cycle wherein the diaphragm 18 is moved from right to left as viewed in FIGURE 1 until the cup rests against the end wall 23. During this phase air which is within the supply chamber 20 will pass through the aperture 38, openings 47 in the valve element 42 and lift the valve element 48 from its position upon the seat 51 thereby gaining access to the passage 35 and the oral cavity of the patient.

After the operator ceases to exert exhaling pressure and proceeds to inhale, air from the surrounding atmosphere will pass through the inlet port 67' to supply the operator with fresh air. At the same time the respiratory gases which filled the pressure chamber 21 will be pushed against the valve element 63 thereby closing that valve element and continued pressure will move the valve element 57 from left to right away from the seat 60 thus permitting the respiratory gases to pass outwardly through the vent openings 59. Expulsion of the respiratory gases in the manner described is assisted by action of the spring 22 which tends to move the diaphragm from left to right as viewed in FIGURE 1.

At the same time air from the surrounding atmosphere is drawn through the air supply passage 34 unseating the valve element 30 from its seat and thus fills the supply chamber 20 with fresh air to the maximum capacity of the chamber. During the filling phase the valve element 48 is seated upon its seat to prevent respiratory gases from the patient finding their way into the supply chamber 20. At the same time the patient is exhaling and the respiratory gases pass through the passage 59 unseating the valve element 42 thereby finding their way past the valve seat 46 through the openings 41 comprising the exhaust port into the surrounding atmosphere. It will be appreciated that where tanks 75 and 77 are connected to the appropriate fittings 29 and 66 the fresh air may constitute pure oxygen or other gas supplied to either the patient, operator or both, but that upon exhaling respiratory gases from the patient, operator or both are expelled outwardly to the surounding atmosphere.

In the embodiment of the invention shown in FIGURE 2 valving has been omitted from the operator side of the device where a straight tube 80 is employed to connect the operator mouthpiece 11 with a bushing 81 on the part 14 of the housing 12. Valving is also omitted from the bushing 81. The valves previously described, however, are employed on the patient side. In this more simplified form of the invention the same safeguards are present in that the housing provides a supply chamber 20 the maximum capacity of which is adapted to the type of patient to whom the resuscitation is to be administered. In this instance the operator inhales through the side of his mouth and exhales through the mouthpiece to a sufficient extent to shift the diaphragm 18 from right to left when fresh air is to be pushed into the lungs of the patient. After this phase of the operation the operator merely removes his mouth temporarily from the operator mouthpiece during which time the spring 22 returns the diaphragm 18 and effects a filling of the supply chamber 20 with fresh air.

For use with infants the supply passage customarily is made with a capacity of about 70 cubic centimeters which

is a volume very slightly in excess of the need of an infant. Where the device is for use in resuscitating adult patients the supply chamber is made with a capacity of about 800 cubic centimeters. A device of the last described capacity is also suitable for children even though the lung capacity of children may be as low as 300 cubic centimeters for the reason that with children over pressuring is not harmful, at least to an extent defined by the maximum capacity herein made reference to.

From the foregoing description it will be clear that regardless of how the device might be operated no more air can be pressured into the lungs of the patient than can be contained within the supply chamber 20 for each cycle. For best results it is advisable to apply pressure at a recommended rhythm of from 6 operations per minute to 10 or 12 operations per minute. The latter rate is an approximate rate when under stimulated conditions. Since the rate of application of air to the lungs of the patient is substantially the same as the average rate of breathing of the operator the resuscitation procedure can continue for long periods of time without fatigue to the operator and moreover without the prospect of tiring the operator by reason of making the operator's intake of fresh air restricted in any fashion. Also there remains a sufficient distance between the operator and the patient and absence of physical contact so that there need be no psychological impediment to an effective and efficient administration of the procedure. Where resuscitation may need to continue for a time longer than one operator can support a second or additional operators each supplied with an individual mouthpiece can be substituted from time to time without it being necessary to remove the patient's mouthpiece from the patient's mouth.

In the event that employment of normal air might become insufficient during any interval during the administration oxygen can be connected to the supply for the patient at any time without interruption of the administrating technique.

Although I have herein shown and described my invention in what I have conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of my invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent structures and devices.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A mouth to mouth resuscitator comprising a supply chamber member and a pressure chamber member attached to the supply chamber member, an imperforate movable partition separating the interiors of said members from communication with each other, an operator mouthpiece in communication with the interior of the pressure chamber member, a patient mouthpiece in communication with the interior of said supply chamber member, the interior of said supply chamber member and a space adjacent the operator mouthpiece each having a separate fresh gas supply port in communication between the respective interior and the exterior, each said supply port having an inflow check valve therein, a passageway between the interior of each of the chamber members and the respective mouthpiece, the passageway adjacent the patient mouthpiece having an inflow check valve therein and the other passageway having an outflow check valve therein, and a valved vent port from the pressure chamber member and from the passageway adjacent the patient mouthpiece to the exterior.

2. A mouth to mouth resuscitator comprising a mouthpiece insertable in the oral cavity of a patient, and having a passage therethrough, means forming a gas supply chamber of variable size in communication with said passage, means forming a gas pressure chamber, and an operator mouthpiece in communication with said pressure chamber, said supply chamber having a maximum fixed capacity not exceeding a normal expanded lung

capacity of the patient, a movable partition separating said chambers, and means operably associated with said partition biased in a direction moving said partition to a position enlarging said supply chamber to maximum capacity, a supply port in communication with said supply chamber having a check valve therein open to inflow of gas, a double acting check valve device between the supply chamber and said passage, said check valve device having an element movable to open position under flow of gas from said chamber to said passage and to closed position under flow of gas from said passage, an exhaust port means between said passage and atmosphere, and another element of said check valve device in said passage and movable to a position closing said exhaust port under flow of gas from said chamber to said passage and to a position opening said exhaust port under flow of gas from said passage, said operator mouthpiece including a pressure passage communicating with said pressure chamber, a pressure vent port between said pressure chamber and atmosphere, a double acting valve device having an element movable to open position under flow of gas from said operator mouthpiece to said pressure chamber and to closed position upon release of said last flow, said last valve device having another element movable to a position opening said vent port under flow of gas from said pressure chamber, an inlet port between atmosphere and said operator mouthpiece, and a check valve in said inlet port movable to open position under flow of gas into said operator mouthpiece.

3. A mouth to mouth resuscitator comprising a mouthpiece insertable in the oral cavity of a patient, and having a passage therethrough, a housing having a flexible partition therein dividing said housing into a gas supply chamber of variable size and a gas pressure chamber of variable size, said supply chamber having a maximum fixed capacity not exceeding a normal expanded lung capacity of the patient, said supply chamber being in communication with said passage, and resilient means operably associated with said partition biased in a direction moving said partition to a position enlarging said supply chamber to maximum capacity, a supply port in communication with said supply chamber having a check valve therein open to inflow of gas, a check valve element in said passage movable to open position under flow of gas from said chamber to said passage and to closed position under flow of gas from said passage, an exhaust port means between said passage and atmosphere, a check valve element between said passage and said exhaust port and movable to a position closing said exhaust port under flow of gas from said chamber to said passage and to a position opening said exhaust port under flow of gas from said passage, an operator mouthpiece, a tube connecting said operator mouthpiece and said housing, said tube comprising a pressure passage communicating between said last mouthpiece and said pressure chamber and forming with said mouthpiece and said pressure chamber a composite pressure cavity, a pressure vent port between said cavity and atmosphere, a check valve element in said tube movable to open position under flow of gas from said operator mouthpiece to said pressure chamber and to closed position upon release of said last flow, a check valve element between said cavity and said vent port movable to a position opening said vent port under flow of gas from said pressure chamber, an inlet port between atmosphere and said cavity on the side of said last check valve nearest the operator mouthpiece and a check valve in said inlet port movable to open position under flow of gas into said cavity.

4. A mouth to mouth resuscitator comprising a mouthpiece insertable in the oral cavity of a patient and having a passage therethrough, a housing having a flexible partition therein dividing said housing into a gas supply chamber and a gas pressure chamber both of variable size, said supply chamber having a maximum capacity not exceeding a normal expanded lung capacity of the patient, said

supply chamber being in communication with said passage, and resilient means operably associated with said partition biased in a direction moving said partition to a position enlarging said supply chamber to maximum capacity, a supply port in communication with said supply chamber having a single acting check valve therein open to inflow of gas, a double acting check valve device between the supply chamber and said passage having two valve elements, one of said valve elements being movable to open position under flow of gas from said chamber to said passage and to closed position under flow of gas from said passage, an exhaust port means between said passage and atmosphere, and another of said valve elements being in said passage and movable to a position closing said exhaust port under flow of gas from said chamber to said passage and to a position opening said exhaust port under flow of gas from said passage, an operator mouthpiece, a tube connecting said operator mouthpiece and said housing, said tube comprising a pressure passage communicating between said mouthpiece and said pressure chamber and forming with said last mouthpiece and said pressure chamber a composite pressure cavity, a pressure vent port between said cavity and atmosphere, a double acting valve device having two valve

elements, one of said last identified valve elements being movable to open position under flow of gas from said operator mouthpiece to said pressure chamber and to closed position upon release of said last flow, the other of said last identified valve elements being movable to a position opening said vent port under flow of gas from said pressure chamber, an inlet port between atmosphere and said cavity on the side of said last double acting check valve nearest the operator mouthpiece, and a check valve in said inlet port movable to open position under flow of gas into said cavity, said single acting check valves having means operatively associated therewith for attachment to gas supplies of selected character.

References Cited in the file of this patent

UNITED STATES PATENTS

2,428,451	Emerson	Oct. 7, 1947
2,766,753	Koch	Oct. 16, 1956
2,887,104	Sovinsky	May 19, 1959

FOREIGN PATENTS

1,204,285	France	Aug. 3, 1959
1,207,372	France	Aug. 31, 1959